

REMARKS

Please reconsider the application in view of the following remarks. Applicant thanks the Examiner for indicating that claim 35 contains allowable subject matter.

Disposition of Claims

Claims 10-12, 15, 17, 18, and 20-35 are pending in this application. Claims 28 and 30 were withdrawn by the Examiner as being directed to a non-elected invention. Claims 10, 21, 32, and 33 are independent. The remaining claims depend, directly or indirectly, from claims 10, 21, and 33.

Amendments

Amendments to the specification were made to correct minor typographical errors. No new matter was added by way of these amendments.

Information Disclosure Statement

The Examiner has noted that the Information Disclosure Statement filed May 25, 2005 fails (in part) to comply with 37 CFR 1.98(a)(3) because it does not include a concise explanation of the relevance of each patent listed. However, Applicant respectfully notes that a translated Office Action was submitted, noted at BC, with the Information Disclosure Statement of May 25, 2005. The Office Action cites the documents the Examiner has currently marked as not having been considered. Additionally, the Office Action details the relevance of each of these non-English references. Pursuant to MPEP 609, "where the information listed is not in the English language, but was cited in a search report or other action by a foreign patent office in a counterpart foreign application, the requirement for a concise explanation of relevance can be satisfied by submitting an English language version of the search report or action which

indicates the degree of relevance found by the foreign office.” Applicant notes that references BC and BD were inadvertently listed under the heading Foreign Patent Documents instead of Non Patent Literature Documents. Accordingly, Applicant submitted an additional IDS on February 14, 2006 to clarify the references listed in the IDS previously filed on May 25, 2005. Accordingly, Applicant respectfully requests full consideration of all references listed on the Information Disclosure Statements of May 25, 2005 and February 14, 2006.

Objections

The illustrations included with the response to Office Action on October 11, 2005 were objected to for being informal and for not corresponding to the Brief Description of the Drawings in Applicant’s disclosure. Applicant respectfully submits that Figures 1A-1D and 2A-2D were simply provided to clarify the present invention to the Examiner. These figures were not to be added to the specification. Applicant apologizes for any confusion this may have caused the Examiner.

Claim 35 is objected to as being dependent upon a rejected base claim. Claim 35 depends from independent claim 33. Applicant believes claim 33 is allowable for the reasons stated below. Accordingly, claim 35 has not been rewritten in independent form at this time.

Rejections under 35 U.S.C. § 112

Claims 29 and 32 stand rejected under 35 U.S.C. § 112, first paragraph, for failing to comply with the enablement requirement. Claims 29 and 32 stand rejected under 35 U.S.C. § 112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter that Applicant regards as the invention. Both of these rejections are respectfully traversed.

Applicant respectfully notes that on page 14 of the specification, in the paragraph beginning on line 3, a presser member with notches on the outer periphery is disclosed. In particular, the outer periphery of the presser member 31 has four notches 31c formed at an equal interval in the peripheral direction. It is further disclosed that the notches 31c are used for rotating the presser member 31 in a way that engages with a tool. Thus, claims 29 and 32 are both enabled and definite. Accordingly, Applicant respectfully requests withdrawal of these rejections.

Rejections under 35 U.S.C. § 103

A. Claims 10, 11, 17, 18, 20, 29, 33, and 34 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,155,376, issued to Cheng (“Cheng”), in view of U.S. Patent No. 5,000,636, issued to Wallace (“Wallace”). This rejection is respectfully traversed.

Applicants have discovered, through detailed experiments and studies, that a presser member may loosen due to impacts and vibrations in an electrically driven power steering apparatus. According to independent claim 10, a presser member has a connecting device to limit the relative rotation between the presser member and the ball screw nut, even if a bonding force between the threads is lost, wherein the function of limiting the relative rotation is performed *after* the threads are fastened. The function of limiting the relative rotation is performed after the threads may be fastened by, for example, means of a shearing force of a resin member filled into communication holes respectively provided with the presser member and the ball screw nut or deforming part of the presser member toward the ball screw nut.

Independent claim 33 recites a method of manufacturing an electrically driven power steering apparatus, the method including engaging a thread of a presser member with a thread of a ball screw nut and limiting relative rotation between the presser member and the ball screw nut *after* the engaging.

Embodiments of the present invention advantageously provide an electrically driven power steering apparatus and a method of manufacturing an electrically driven power steering apparatus wherein a pre-load and a rotation prevention allowance torque of the presser member is controlled within an adequate range.

Cheng discloses a lock nut (80). The lock nut of Cheng does not stop a relative rotation of the lock nut if a thread thereof loosens. Cheng is completely silent with respect to limiting relative rotation as claimed. Cheng does not show or suggest a connecting device capable of limiting a relative rotation between the presser member and the ball screw nut despite loss of a bonding force between the threads. Further, Chang fails to show or suggest the limiting a relative rotation being performed *after* the threads are fastened, as recited in independent claims 10 and 33.

Wallace discloses a thread on which a filler is coated *prior to assembly* of the thread. The thread of Wallace, thus, performs a function of limiting a relative rotation *as the thread is fastened*. Because the filler is coated on the threads prior to assembly, a large screwing torque is required to fasten the thread and the mating threaded member. This creates a problem where a fastening torque limits a rotation prevention allowance torque. Moreover, the rotation prevention allowance torque may be changed in accordance with a fastening condition (e.g., a temperature, fastening method, etc.) so that it is difficult to set a fastening torque of the thread within an adequate range. In addition, when a film thickness is large, a fastening resistance is

induced. When a film thickness is small, a rotation prevention effect is reduced. Thus, Wallace fails to show or suggest limiting a relative rotation being performed *after* the threads are fastened, as recited in independent claims 10 and 33.

In view of the above, Cheng and Wallace, whether considered separately or in combination, fail to show or suggest the present invention as recited in independent claims 10 and 33. Thus, claims 10 and 33 are patentable over Cheng and Wallace. Dependent claims are allowable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

B. Claims 10, 12, 15, 21, 22, 24-27, 31 and 32 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Cheng in view of U.S. Patent No. 5,827,027, issued to Wakabayashi ("Wakabayashi"). This rejection is respectfully traversed.

As discussed above, Cheng fails to show or suggest the present invention as recited in claim 10. The lock nut of Cheng does not stop a relative rotation of the lock nut if a thread thereof loosens. Cheng does not show or suggest a connecting device as recited in the claims. Additionally, Cheng fails to show or suggest the limiting relative rotation being performed after the threads are fastened, as recited in independent claim 10.

Claim 21 recites an electrically driven power steering apparatus comprising a presser member screwed to a ball screw nut for pressing a bearing against the ball screw nut. The presser member has a connecting device capable of limiting a relative rotation between the presser member and the ball screw nut by deforming at least one part of a thin cylindrical portion toward the ball screw nut. The function of limiting a relative rotation is performed *after* the threads are fastened.

Claim 32 recites an electrically driven power steering apparatus including a housing, a ball screw shaft extending within the housing and connected to a steering mechanism, a motor having a rotor, a ball screw nut connected to the rotor of the motor, a bearing for supporting the ball screw nut so as to be rotatable with respect to the housing, and a presser member screwed to the ball screw nut for pressing the bearing against the ball screw nut. The presser member has a connecting device capable of limiting a relative rotation between the presser member and the ball screw nut by deforming at least one part of a thin cylindrical portion toward the ball screw nut, thereby by limiting a relative rotation *after* the threads are fastened. The relative rotation between the presser member and the ball screw nut is limited by a frictional force exerted between the deformed part of the thin cylindrical portion and the ball screw nut. The presser member has a female thread, the ball screw nut has a male thread engaged with the female thread, the presser member abuts the bearing rotatably supporting the ball screw nut, and the presser member has a part with which a tool for rotating the pressing member is engaged.

As noted above, the lock nut of Cheng does not stop a relative rotation of the lock nut if a thread thereof loosens. Cheng does not show or suggest a connecting device as recited in independent claim 32. Additionally, Cheng fails to show or suggest the limiting relative rotation being performed *after* the threads are fastened, as recited in independent claims 21 and 32.

Wakabayashi discloses a thread which is previously deformed. The deformed thread of Wakabayashi, however, performs a function of limiting a relative rotation *as the thread is fastened*. Therefore, it is difficult to set a rotation prevention allowance torque for the thread within an adequate range due to an excessive fastening torque. Additionally, when a deformation of the previously deformed thread is large, a fastening resistance is induced. When the deformation of the previously deformed thread is small, a rotation prevention effect is

reduced. Further, when the rotation prevention force is given by an elastic deformation, a rotation prevention effect sufficient for the electric power steering apparatus can not be achieved.

In contrast, in accordance with the present invention as recited in independent claims 10 and 32, a function of limiting a relative rotation is performed *after the threads are fastened*. For example, in the embodiment of Fig. 4 of the present application, a thin cylindrical portion 31b of the presser member 31 is caulked (plastically deformed), after a proper pre-load is applied by rotating the presser member 31. The deformed thin cylindrical portion 31b performs the function of limiting a relative rotation. Accordingly, a pre-load and a rotation prevention allowance torque of the presser member 31 are controlled within an adequate range. A deformation *before* fastening, similar to Wakabayashi, can make it impossible to fasten the thread. Therefore, a large deformation is limited. On the other hand, a deformation *after* fastening, as recited in the present invention, can provide a larger deformation, because it is not necessary to further fasten the thread. Thus, limiting the relative rotation between the presser member and the ball screw nut of the present invention is more accurately controlled. Wakabayashi fails to show or suggest limiting a relative rotation being performed *after* the threads are fastened, as recited in independent claims 10, 21 and 32. Further, Wakabayashi fails to show or suggest a presser member having a connecting device capable of limiting the relative rotation between the presser member and the ball screw nut by deforming at least one part of a thin cylindrical portion toward the ball screw nut, as recited in claim 32.

In view of the above, Cheng and Wakabayashi, whether considered separately or in combination, fail to show or suggest an electrically driven power steering apparatus as recited in independent claims 10, 21 and 32. Accordingly, claims 10, 21 and 32 are patentable over

Cheng and Wakabayashi. Dependent claims are allowable for at least the same reasons. Accordingly, withdrawal of this rejection is respectfully requested.

C. Claim 23 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Chen in view of Wakabayashi and further in view of Wallace. This rejection is respectfully traversed.

As discussed above, claim 21 is patentable over Cheng and Wakabayashi, whether considered separately or in combination. Also as discussed above, Wallace fails to show or suggest that which Cheng and Wakabayashi lack. Claim 23 depends from claim 21. Accordingly, claim 23 is patentable over Cheng, Wakabayashi, and Wallace, whether considered separately or in combination. Accordingly, withdrawal of this rejection is respectfully requested.

Conclusion

Applicant believes this reply is fully responsive to all outstanding issues and places this application in condition for allowance. If this belief is incorrect, or other issues arise, the Examiner is encouraged to contact the undersigned or his associates at the telephone number listed below. Please apply any charges not covered, or any credits, to Deposit Account 50-0591 (Reference Number 10122/005002).

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Respectfully submitted,

By 

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Attachments